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I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General.

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1. Your reference — ~~JL/SV/020103~~ P3927 A1/PDW

2. Patent application number *(The Patent Office will fill in this part)* — 0300024.7 — 03 JAN 2003

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

JONATHAN LAKER
90 HIGH ROAD WEST
FELIXSTOWE
SUFFOLK IP11 9JE

Patents ADP number *(if you know it)* — 8563674001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention — DEVICE

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

~~NONE ASSIGNED AT PRESENT~~

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Patents ADP number *(if you know it)*

ASI/77 MG 5.6.03

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
NO		

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
NO	

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

NO

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	12
Claim *(s)*	0
Abstract	1
Drawing *(s)*	6 only 1k

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	0
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	0

11. ~~I/~~We request the grant of a patent on the basis of this application.

Signature Date 03/01/03

12. Name and daytime telephone number of person to contact in the United Kingdom

~~JONATHAN LAKER~~ Peter Wilson
~~07801 030625 – 01394 276275~~ 01473 660 600

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Notes

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DUPLICATE

TITLE: DEVICE

The present invention relates to a device, notably to a flow responsive device for fitting to the outlet of a water tap.

BACKGROUND TO THE INVENTION:

A conventional water tap for controlling the supply of water or other fluid to a locus comprises an inlet adapted to be connected to the water mains or other supply of water or other fluid; a valve mechanism for controlling the flow of water through the tap; and an outlet orifice through which the flow of water discharges to the locus, for example into a basin, bath or the like. Such taps can take many forms and can be connected to both hot and cold water supplies to produce a mixed outlet stream of hot and cold water at some intermediate temperature. For convenience, the term tap will be used herein to denote in general all forms of such taps.

Such taps find use wherever a user desires to control the supply of water or other fluid to a locus, such as a hand basin or bath. However, the invention is of especial application in the supply of hot and/or cold water in a domestic situation and will be described hereinafter in terms of such an application.

It has become common practice to fit the outlet to the tap with an insert which aids even distribution of the outlet flow across the transverse area of the outlet orifice. Such inserts also aid uniform mixing of hot and cold water to minimise the risk that the user may scald his hands if the hot water stream is not adequately mixed with the cold water stream. Typically, such inserts take the form of a transverse metal, plastic or ceramic plug which is a push, screw or other fit into the outlet orifice and which has a plurality of axial bores through the plug. The bores are sized and located so that when the tap valve is fully open there is a uniform flow of water across the plug giving a generally cylindrical jet of water from the tap. Typically, the combined cross sectional area of the bores in the plug is marginally less than that required to accommodate the full flow rate of water through the valve mechanism so that the plug causes a small back pressure at the tap outlet to create a jet of water from the

tap. However, when the tap valve is only partially opened, the combined cross sectional area of the bores in the plug exceeds that required to accommodate the flow of water through the plug. The water then issues from the tap outlet as slow flow of water due to the lack of pressure drop across the plug. Since the plane of the tap outlet is usually inclined at from 5 to 15□ to the horizontal to project the jet of water from the tap towards the centre of the basin it serves, the slow flow of water does not fill the outlet orifice, but issues as a shallow flow over an arc at the lower portion of the plug. This shallow flow of water not only gives the appearance of a slow rate of flow of the water, but is aesthetically unacceptable to a user since the flow is in the form of a sluggish dribble from the tap. Therefore, most users will tend to open the valve of the tap further to achieve an aesthetically pleasing full jet of water from the tap outlet. This is wasteful of water, especially where the user only intermittently uses the water, for example in wetting a toothbrush or wetting his hands when washing his face. Furthermore, in opening the valve of a hot tap fully, there is a greater risk of the user scalding himself where the water is at an elevated temperature and is not mixed with cold water in a mixer tap.

It has been proposed to incorporate a flow/pressure responsive device in the tap outlet which controls the outflow of water when the tap valve is only partially opened, thus causing the water to issue as an array of jets at low flow rates; but allows a full flow of water when the tap valve is fully open. Thus, in British Patent No 2 063 104 B a shower head is provided with a spring loaded obturator at its outlet. The obturator moves against the spring bias away from its seat in the shower head as the water flow and hence the water pressure applied to its upstream face increases. This movement increases the size of the annular gap between the obturator and the body of the shower head to provide a larger flow path to accommodate the larger flow rate fed to the shower head. However, the obturator in such a design will tend to move rapidly in response to fluctuations in the water flow and/or water pressure applied to its upstream face. Hence, there is a tendency for the outflow of water from such a design to fluctuate and in an extreme case the flow can oscillate between the maximum and minimum flow rate causing hammering within the device and associated pipe work.

We believe that once the obturator has moved in response to the initial increase in pressure on its upstream face, there will be little or no pressure drop across the obturator since the outlet and the upstream passages in the shower head are all vented to atmospheric pressure. The obturator will thus be free to move under the influence of the bias spring resulting in rapid shutting of the annular outlet gap by the obturator. This causes a rapid build up of pressure upstream of the obturator causing the obturator to move rapidly to the open position, repeating the cycle of opening and shutting movement of the obturator.

It has also been proposed, for example in US Patent No 5,114 072, to introduce air into the water stream to give a soft aerated flow of water, particularly in shower heads. This is achieved in a ported plug which is inserted into or formed within the outlet to the tap or shower head which draws air into the water as it flows through the plug. Such a plug may contain a flow responsive component of the type described above. Such an aerated flow gives the impression of a full flow of water at low flow rates, but limits the maximum flow of water which can be achieved without significant enlargement of the tap or shower outlet.

It has also been proposed in US Patent No 4 352 462 to form a nozzle, which is used to inject cleansing water into a vessel containing a sludge, with a closure member to prevent back flow of sludge into the fluid flow passages of the nozzle. The closure member comprises an obturator which is spring biased to seat against the exterior of the nozzle housing so as to close off the nozzle outlet when cleansing water is not flowing through the nozzle. The obturator is connected by a rod to a transverse plate which is housed within a wider diameter portion of the fluid flow passage through the nozzle housing. The plate member buts against the shoulders formed in the wall at each end of the larger diameter portion at the extremes of its axial travel and thus limits the axial movement of the obturator. A bias compression coil spring is trapped between the transverse plate and the downstream shoulder to bias the obturator to seat against the nozzle orifice and close the orifice. The sole function of the transverse plate is to limit the axial movement of the obturator and it does not act in any way as a flow regulator. Furthermore, in its rest position when now water flows through the nozzle, the obturator seals the nozzle orifice so as to

prevent ingress of sludge solids into the nozzle orifice. If such a device were used to regulate the flow of cleansing fluid through the nozzle orifice, the pressure acting on the upstream face of the obturator would cause the obturator to oscillate between the open and closed positions for the reasons given above.

I have now devised a form of pressure responsive device for use at the outlet of a tap, shower head or other fluid dispenser which reduces the above problems.

SUMMARY OF THE INVENTION:

Accordingly, the present invention provides a device for use upon a tap, shower head or other fluid dispensing apparatus, which apparatus is for controlling the supply of water or other fluid to a locus and comprises a body having an inlet adapted to be connected to a supply of water or other fluid, a passive or active method of restricting the maximum flow of liquid through the device, Dual concentric outlet paths through which the fluid is to be discharged to the locus, a fluid path between said inlet and said outlets and a valve mechanism located to control the discharge of liquid through the device at high flow rates, which device comprises:

a. A body member adapted to be mounted on or in the outlet to the apparatus and in the flow path of fluid through said outlet, said body member defining one or more fluid flow paths through the device;

b. A flow responsive mechanism mounted on or in said body member that controls the discharge of the flow of liquid at high flow rates, which flow mechanism is adapted to operate within the device in response to the flow of fluid applied to said body member, characterised in that;

c. The flow responsive mechanism of the device comprises of a diaphragm snap valve located respectively upstream of the high flow discharge flow paths.

d. The diaphragm snap valve is concentrically mounted across the inner concentric discharge path although it could be configured so that the valve controlled the outer discharge path if so desired.

e. The diaphragm snap valve is mounted so that it configured so that the inlet flow of liquid through the restrictor enters a chamber and is directed towards the outer discharge path through an array of discharge jets.

f. Under low flow conditions the cross axial section of the discharge holes in the outer flow path is sufficient to allow the volume of water to pass through the device without generating sufficient pressure in the chamber to effect the operation of the diaphragm snap valve.

g. As the flow of liquid is increased through the flow regulator this causes the pressure in the chamber to increase due to the cross axial section of the discharge holes in the outer flow path being fixed.

h. The increased pressure in the chamber caused by the increased flow of liquid through the restrictor acts upon the outer surface of the diaphragm snap valve which is retained in its closed position by the domed top pushing the sections together.

i. At a controlled point the applied pressure acting on the top surface of the diaphragm snap valve is beyond the holding characteristics and this causes the inner sections to inwardly roll towards the centre of the diaphragm snap valve therefore creating an aperture which the liquid can flow through the device accordingly.

j. In this state the flow of liquid through the restrictor plate discharges through the array of spray jets around the outer coaxial paths, the diaphragm snap valve and out through an array of jets / diffusion screen / aerator or flow straighteners to atmospheric pressure.

k. The cross section area of the discharge path controlled by the diaphragm snap valve is designed so that there is always positive pressure acting on the valve to retain the valve in the open position whilst the unit is in the high flow mode.

l. The flow rate in which the unit changes is controlled by the characteristic of the valve and the cross sectional area of the flow paths. The change over between the two states is virtually instantaneous offering a logic of A or A+B unlike other proposed flow devices which have a proportional output in relation to the flow of liquid through the device.

As indicated above, the invention can be applied to fluid dispensing apparatus other than taps and the valve mechanism controlling the flow of water or other fluid through the discharge outlet may be located remotely from the outlet, as with a shower head. The term tap is therefore used herein to denote in general all such dispensing apparatus and the invention will, for convenience be described in terms of a tap or faucet.

The optimum dimensions for the various components of the device, the strength of diaphragm valve and the size of apertures in both flow paths can readily be determined by simple trial and error tests. The device readily lends itself to fabrication of the components from injection moulded or cast engineering plastics or by machining. The components are conveniently assembled upon one another using any suitable technique, for example by the use of adhesive, ultrasonic or other welding or by snap fitting the parts together.

The device is preferably of a generally cylindrical shape so that the internal components and the fluid flow paths through the device are radially substantially symmetrical about the longitudinal axis of the device.

The device is provided with means, for example a screw thread, a bayonet type

fitting or a series of circumferential external saw tooth ribs, whereby the device can be secured within the outlet of the tap or other apparatus.

DESCRIPTION OF THE DRAWINGS:

The invention will now be described by way of illustration with respect to preferred embodiments of the invention as shown in the accompanying drawings in which -

Figure 1 is a longitudinal cross section and end view of an embodiment of the device which is provided with an array of holes for high flow discharge.

Figures 2 is a longitudinal cross section under low flow conditions of an embodiment of the device which is provided with an array of holes for high flow discharge.

Figures 3 is a longitudinal cross section under high flow conditions of an embodiment of the device which is provided with an array of holes for high flow discharge.

Figure 4 is a longitudinal cross section and end view of an embodiment of the device which is provided with an aerator or straightener for high flow discharge.

Figures 5 is a longitudinal cross section under low flow conditions of an embodiment of the device which is provided with an aerator or straightener for high flow discharge.

Figures 6 is a longitudinal cross section under high flow conditions of an embodiment of the device which is provided with an aerator or straightener for high flow discharge.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

The device shown in Figure 1, 2 and 3 comprises a cylindrical body member [1] which has an increased diameter section [2] which locates within the recess of the metal housing ring [3]. The metal housing ring [3] is located into the tap housing [4]

by a threaded arrangement [5].

The cylindrical body member [1] has a flow restriction plate [6] installed at the input end of the unit which is used to restrict the maximum flow of liquid through the device at a given working pressure. The unit is provided with a sealing washer [7] which is compressed by the top section of the body [1], restrictor plate [6] and the inner section of the tap housing [4].

The flow restrictor [6] can be passive as show in the drawing consisting of a cylindrical plate with an array of holes or an active pressure compensating system utilising an O ring and taper cone arrangement for example. For the purpose of illustration the flow restrictor will be show as a simple passive plate.

Within the internal cylindrical body member [1] two flow paths [8] and [9] are provided for the discharge of the liquid. The inner of the concentric flow paths [9] are controlled by a diaphragm snap valve [10] which is located concentrically within the bore.

The diaphragm snap valve [10] is of the type commonly found in non drip caps and sauce bottles and under normal conditions remains in a closed condition.

Figure 2 shows the system in the low flow operation. The liquid [11] flows through the tap [4] bore and through the array of holes [12] in the restrictor plate [6]. The water enters the chamber [13] where it is distributed towards the outer flow path [8] where it issues as an array of spray jets [14].

The pressure that is created within the chamber [13] acts upon the top surface of the diaphragm snap valve [10] but is insufficient to cause the diaphragm snap valve [10] to operate. In this state the low flow rate issuing from the tap bore [4] is converted to an array of spray jets [14].

Figure 3 shows the system in the high flow operation. As the tap is opened further the increased flow through of liquid [11] flows through the tap [4] bore and through

the array of holes [12] in the restrictor plate [6] causes the pressure in the chamber [13] to increase due to the cross axial section of the discharge holes in the outer flow path [8] being fixed. The increased pressure in the chamber [13] caused by the increased flow of liquid through the device acts upon the outer surface of the diaphragm snap valve [10] and at a controlled point the applied pressure acting on the top surface of the diaphragm snap valve [10] is beyond the holding characteristic and this causes the inner sections of diaphragm snap valve [10] to invert and open accordingly.

In this state the flow of liquid through the device discharges through the array of spray jets [14] around the outer coaxial flow path [8], the diaphragm snap valve [10] and out through an array of inner jets [15] located within the inner flow path [9] to atmospheric pressure.

The total cross section area of the discharge path [9] controlled by the diaphragm snap valve [10] is designed so that there is always positive pressure acting on the top surface of the valve [10] to retain the valve in the open position whilst the unit is in the high flow mode.

The flow rate in which the unit changes is controlled by the cross sectional area of the outer flow path [8] and the characteristic of the valve [10]. The change over between the two states is virtually instantaneous offering a logic of A or A+B unlike other proposed flow devices which have a proportional output in relation to the flow of liquid through the device.

As the flow rate of the liquid [11] flowing through the tap [4] bore and through the array of holes [12] in the restrictor plate [6] is reduced this causes the pressure in the chamber [13] to decrease due to the cross axial section of the discharge holes in the outer flow path [8] being fixed. This decreased pressure in the chamber [13] is in sufficient to retain diaphragm snap valve [10] in the open position and the memory in the diaphragm snap valve [10] causes the valve to re-close shutting off the flow path [9] to the inner spray jets [15] in this state the reduced low flow rate issuing from the tap bore [4] is converted to an array of spray jets [14].

The device shown in Figure 4, 5 and 6 comprises a cylindrical body member [1] which has an increased diameter section [2] which locates within the recess of the metal housing ring [3]. The metal housing ring [3] is located into the tap housing [4] by a threaded arrangement [5].

The cylindrical body member [1] has a flow restriction plate [6] installed at the input end of the unit which is used to restrict the maximum flow of liquid through the device at a given working pressure. The unit is provided with a sealing washer [7] which is compressed by the top section of the body [1], restrictor plate [6] and the inner section of the tap housing [4].

The flow restrictor [6] can be passive as show in the drawing consisting of a cylindrical plate with an array of holes or an active pressure compensating system utilising an O ring and taper cone arrangement for example. For the purpose of illustration the flow restrictor will be show as a simple passive plate.

Within the internal cylindrical body member [1] two flow paths [8] and [9] are provided for the discharge of the liquid. The inner of the concentric flow paths [9] are controlled by a diaphragm snap valve [10] which is located concentrically within the bore.

The diaphragm snap valve [10] is of the type commonly found in non drip caps and sauce bottles and under normal conditions remains in a closed condition.

Figure 5 shows the system in the low flow operation. The liquid [11] flows through the tap [4] bore and through the array of holes [12] in the restrictor plate [6]. The water enters the chamber [13] where it is distributed towards the outer flow path [8] where it issues as an array of spray jets [14].

The pressure that is created within the chamber [13] acts upon the top surface of the diaphragm snap valve [10] but is insufficient to cause the diaphragm snap valve [10] to operate. In this state the low flow rate issuing from the tap bore [4] is converted to

an array of spray jets [14]

Figure 6 shows the system in the high flow operation. As the tap is opened further the increased flow through of liquid [11] flows through the tap [4] bore and through the array of holes [12] in the restrictor plate [6] causes the pressure in the chamber [13] to increase due to the cross axial section of the discharge holes in the outer flow path [8] being fixed. The increased pressure in the chamber [13] caused by the increased flow of liquid through the device acts upon the outer surface of the diaphragm snap valve [10] and at a controlled point the applied pressure acting on the top surface of the diaphragm snap valve [10] is beyond the holding characteristic and this causes the inner sections of diaphragm snap valve [10] to invert and open accordingly.

In this state the flow of liquid through the device discharges through the array of spray jets [14] around the outer coaxial flow path [8], the diaphragm snap valve [10] and out through an aerator or straightener [16] to atmospheric pressure.

Aerators or straighteners [16] are well known and are commonly used to aerate water or soften the output from a tap. The device can be a cartridge unit as detailed in the drawings or could be integrally moulded within the body housing so as to reduce the component count. For the purpose of this description the aerator or straightener [16] will be shown as a cartridge assembly

The total cross section area of the discharge path through the aerators or straightener [16] controlled by the diaphragm snap valve [10] is designed so that there is always positive pressure acting on the top surface of the valve [10] to retain the valve in the open position whilst the unit is in the high flow mode.

The flow rate in which the unit changes is controlled by the cross sectional area of the outer flow path [8] and the characteristic of the valve [10]. The change over between the two states is virtually instantaneous offering a logic of A or A+B unlike other proposed flow devices which have a proportional output in relation to the flow of liquid through the device.

As the flow rate of the liquid [11] flowing through the tap [4] bore and through the array of holes [12] in the restrictor plate [6] is reduced this causes the pressure in the chamber [13] to decrease due to the cross axial section of the discharge holes in the outer flow path [8] being fixed. This decreased pressure in the chamber [13] is insufficient to retain diaphragm snap valve [10] in the open position and the memory in the diaphragm snap valve [10] causes the valve to re-close shutting off the flow path [16] to the aerator or straightener. In this state the reduced low flow rate issuing from the tap bore [4] is converted to an array of spray jets [14]

The devices could be provided with an alternative forms in which the cylindrical body member [1] is manufactured in a larger diameter and has a threaded portion allowing the unit to be screwed directly into the tap housing [4] by a threaded arrangement [5]. Such a form of device works in the same way as the device of Figures 1 to 6 but is in a form which can readily be incorporated into a tap outlet during manufacture of the tap, or to replace a conventional flow straightener or aerator already fitted to the tap outlet. The unit could be produced to fit any male or female threaded applications

CLAIMS:

This application is initially filed without claims

ABSTRACT

TITLE: DEVICE

The present invention provides a device for reducing the amount of water or other fluid discharged at a tap, which device comprises a body member having an inlet adapted to be connected to a supply of water or other fluid, dual outlets through which the fluid is to be discharged to the locus, one fluid path between said inlet and said outlet is controlled by a flow/pressure responsive valve mechanism located in the inner fluid path between said inlet and outlet in that the device comprises:

a. a body member adapted to be mounted on or in the outlet to the tap in the flow path of fluid through said outlet;

b. a plurality of fluid flow bores extending through the body member; and

c. a flow/pressure responsive flow regulating means for controlling the flow of fluid through at least some of said bores in response to the flow of fluid applied to said body member, the flow/pressure responsive means comprises of a one piece silicon diaphragm valve mounted within the device.

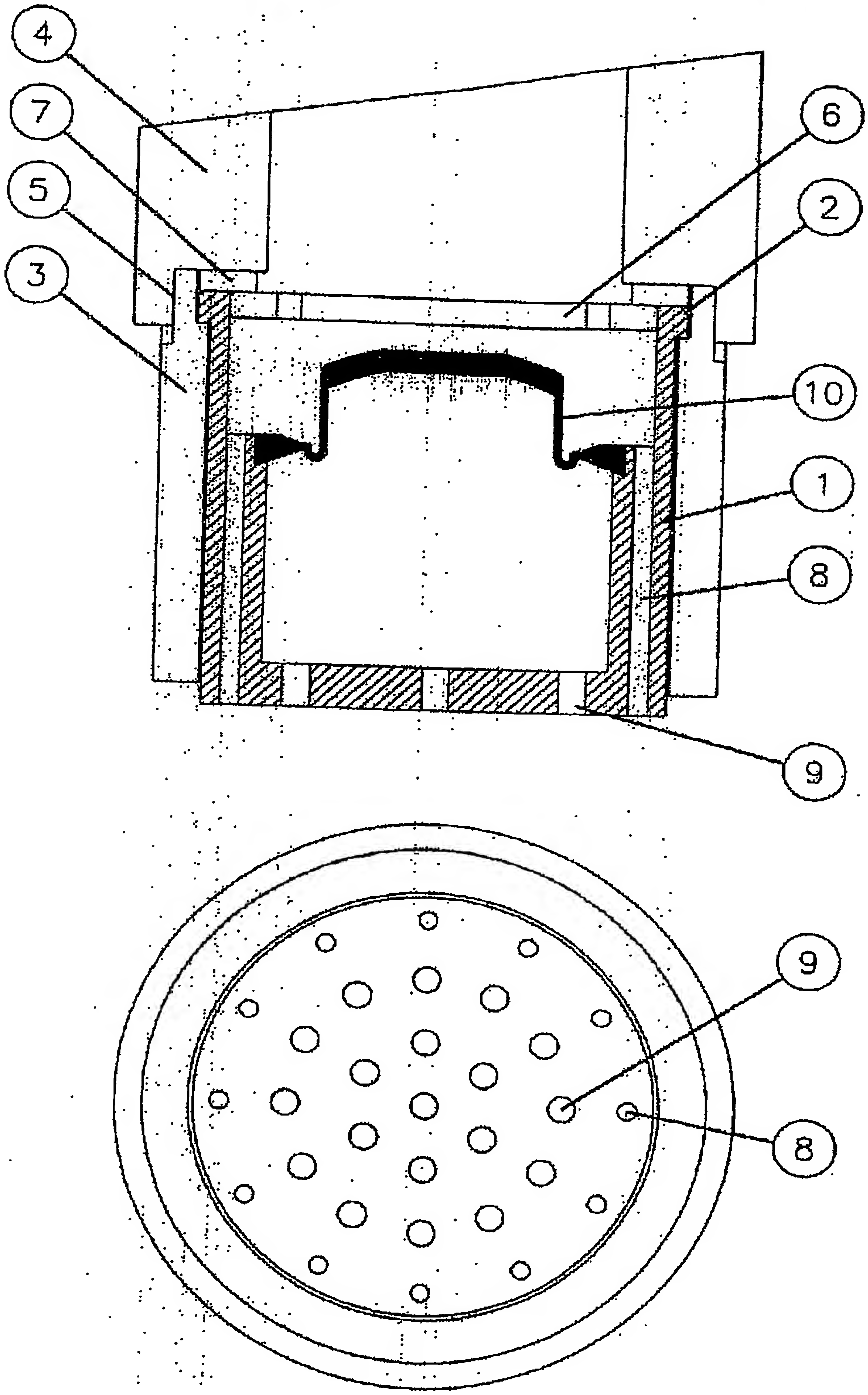

FIGURE 01

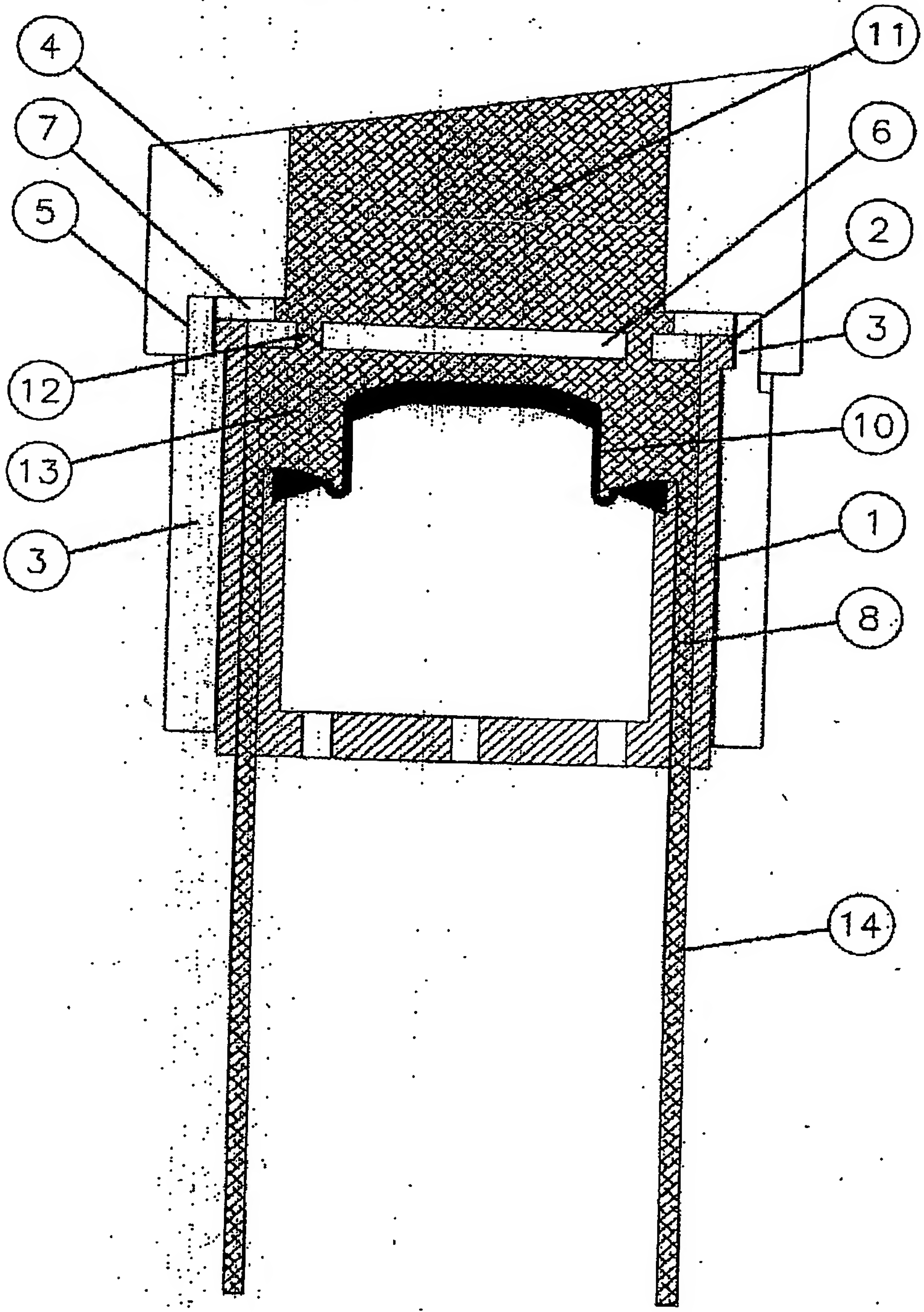

FIGURE 02

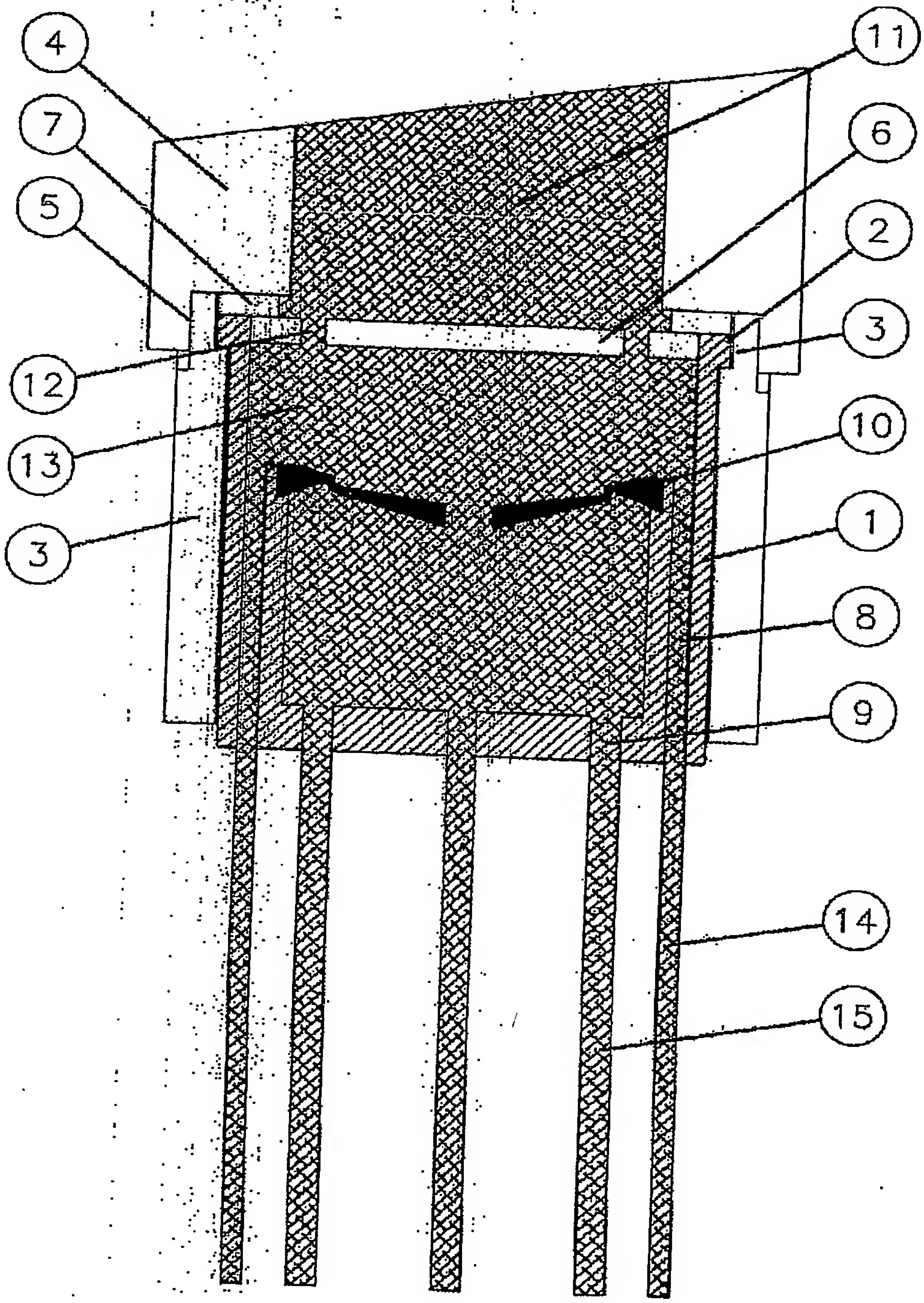

FIGURE 03

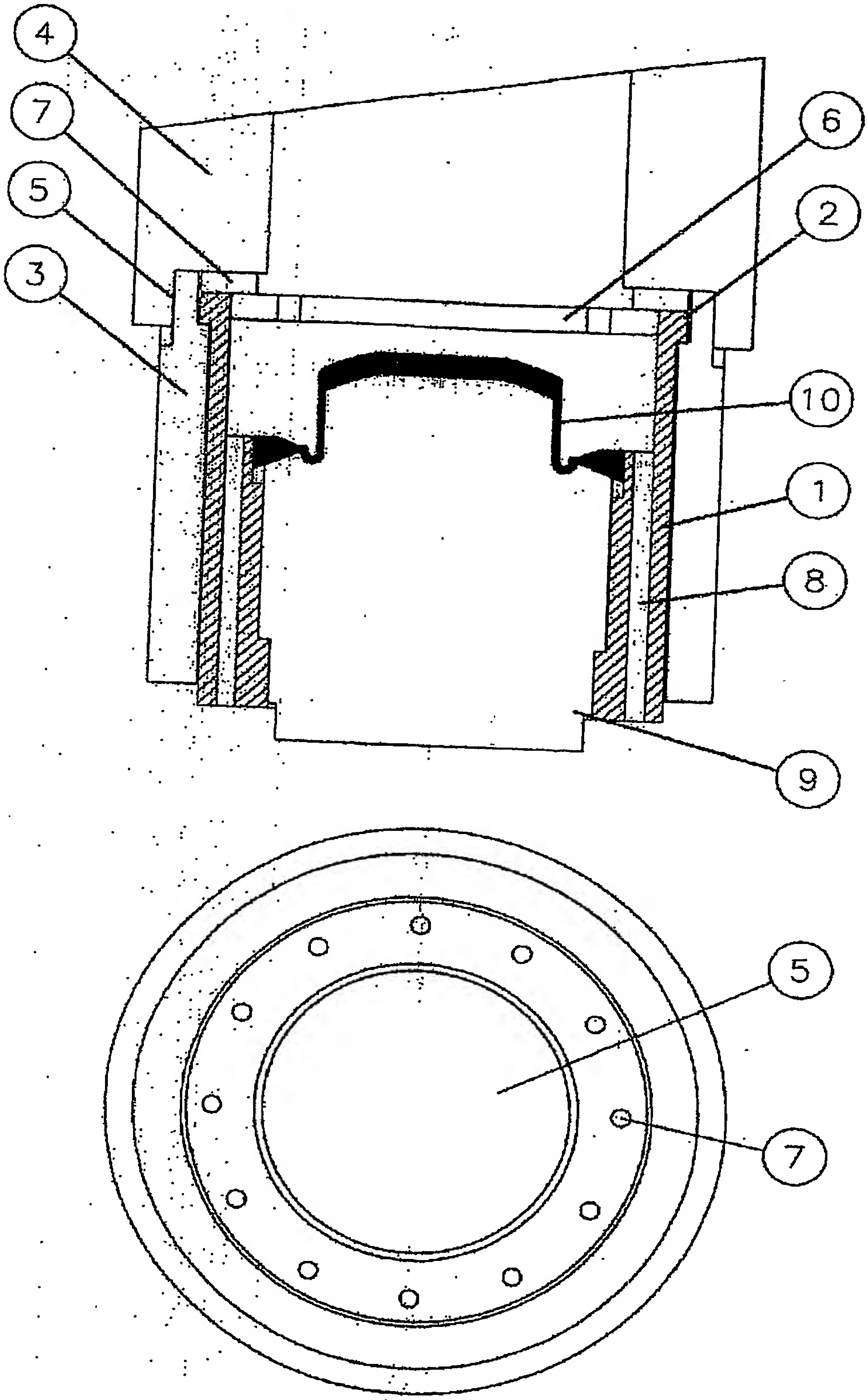

FIGURE 04

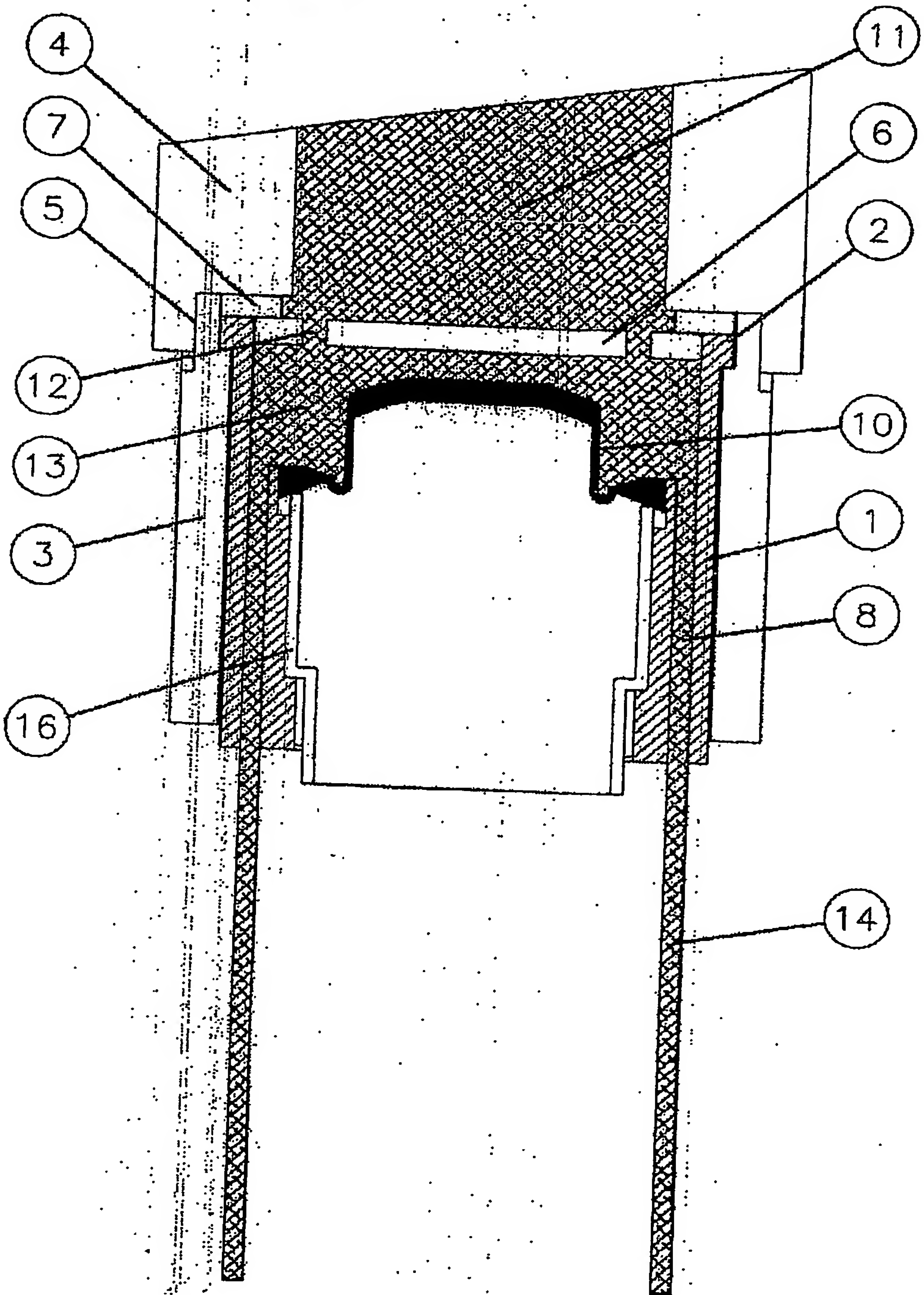

FIGURE 05

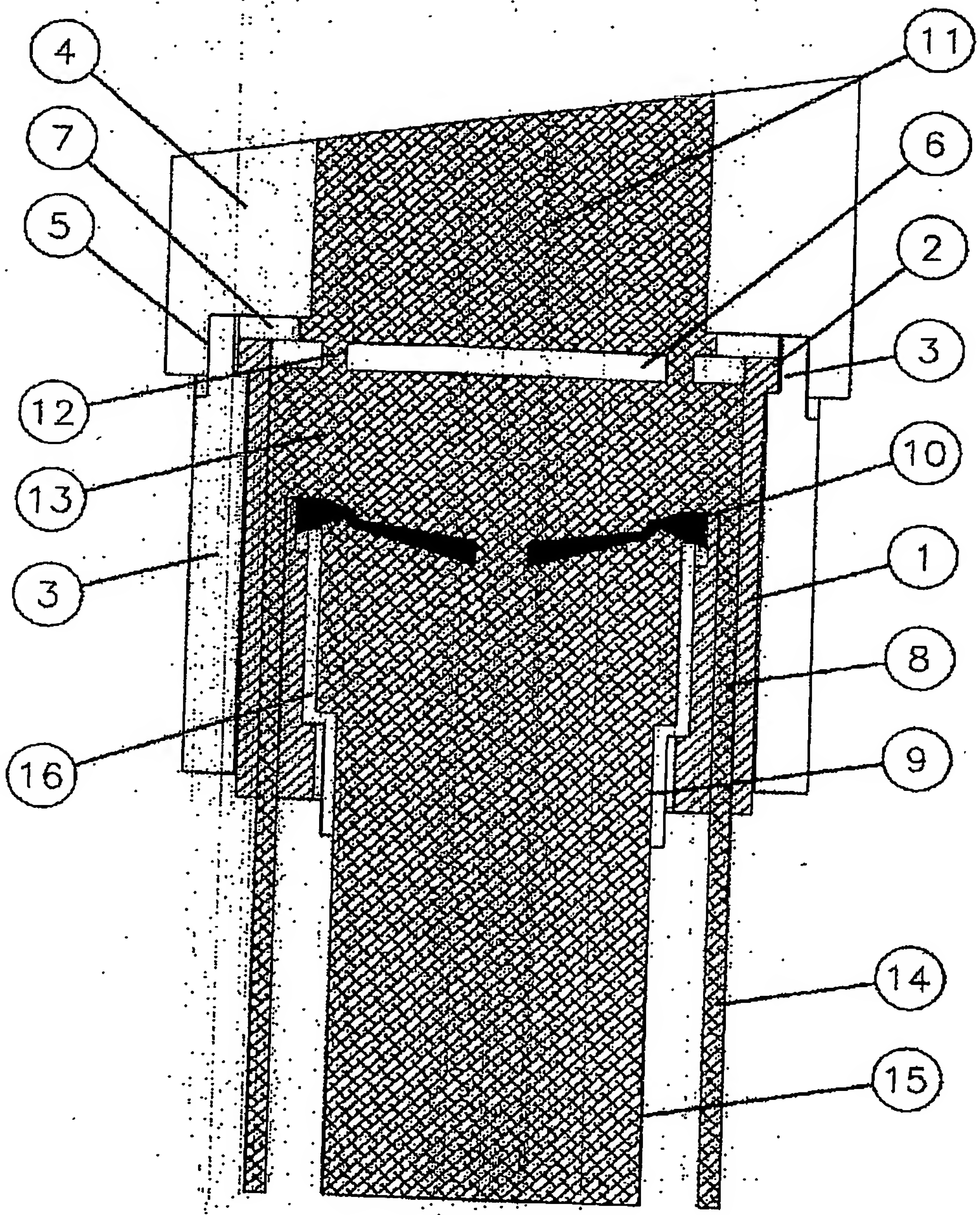

FIGURE 06